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THE GOLD INLAY.

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CHAPTER I.

IN THE past few years I have received many requests to write a series of articles on the making of the gold inlay, but have heretofore refused to do so for the reason that I did not feel that there was a sufficient reason for it, but the recent work of Dr. Hollenbeck on the scientific aspects of casting and his desire that I preface his exposition of the same by a treatise on Cavity preparation for the gold inlay, has induced me to take up the subject again and attempt to amplify my former work.—J. V. Conzett.

It is impossible to have an intelligent appreciation of the preparation of a cavity for the reception of any filling, or indeed the making of any operation looking toward the restoration of lost tooth structure, without a knowledge of Dental Anatomy and Histology, for how can a man properly restore an article of any kind when he does not know the shape, appearance, and function of the original. Neither can a dentist properly restore the lost portion of a tooth if he does not know the original shape, size, and function of the tooth. It is not my purpose to enter into a study of Dental Anatomy and Histology. The subject is too great for the present work, and there is no occasion for it as the splendid work of Dr. Black on Dental Anatomy leaves nothing to be desired in that respect, and the equally good work on Dental Histology by Dr. Noyes furnishes the student with all the necessary know-

ledge on that subject. I do want to urge a study of both works by the student, however, for the reason that he will not be able to intelligently follow the text if he does not know the terminology of Black as revealed in his book. He will not be able to grasp in its entirety the principles laid down for the making of his tooth restorations unless he has an adequate conception of tooth form, alignment, and occlusion as laid down in Dr. Black's book. Neither can he have the full benefit of the system as taught by these great masters if he does not know the structure of the teeth he is working upon. His management of the enamel margins will be entirely empiric if he does not know the structure and arrangement of the enamel rods. He will not be able to most efficiently excavate his cavity if he has not a thoro knowledge of the structure of the dentine, the relation of the pulp to the periphery of the dentine, the recessional lines of the pulp, and the arrangement of the dental tubules. He should have a knowledge of the Cementum and its relation to the enamel, and a thoro knowledge of that most important organ, the Peridental membrane, particularly as to the free gingival, and transseptal fibers that he may avoid injuring or destroying them in the making of his cavities. In my post-graduate work I insist upon a study of tooth form as a prelude to the study of cavity preparation, and as text-books, advise the two already indicated—Black's Dental Anatomy and Noyes's Dental Histology.

Before beginning the preparation of a tooth for the reception of a filling of any kind, there should be a thoro study of the conditions involved in the operation. There are several very important observations to be made and the operator should always have them in mind, but as he progresses in his art, they become so much of routine that he almost unconsciously does it and almost as quickly as a sweep of the mirror about the mouth will indicate.

First he should observe the general tendency to decay, whether the patient is highly susceptible to caries or whether he is almost immune, whether the decay present is of the rapidly destructive type or whether it is of slow character. He should observe the condition of the mouth as to its toilet and the food habits of the patient, whether he is one that lives upon soft, easily masticated foods with a consequent lodgement of masses of soft debris around the gingival margins and between the teeth or whether he is in the habit of chewing his food, as will be indicated by the clean healthy looking gums and the general appearance of health of the tissues. He should observe the alignment of the teeth and the occlusion, should see whether the mesio-distal diameter of the arch has been lost to any appreciable extent as a result of the falling together of the teeth due to the breaking down of the contacts of the various teeth. He should observe the relative masticatory stress that the patient habitually uses, by noting the strength of the masticatory muscles and the indications of abrasion on the crowns of the teeth. He should educate himself to immediately recognize evidences of abnormal excursions of the teeth, either in mastication or as a result of habit and should be so well acquainted with the normal structure and function of the Dental Apparatus that any departure from the normal will be immediately recognized. If these observations do not become a fixed habit in the operator, he will frequently be caught napping and will lay out the lines of his cavity in such a way that he will invite failure.

In the making of a cavity it is necessary to have the proper instruments, but I do not believe in a multiplicity of them. The least number of instruments that will do the work properly is the number to have. Unnecessary multiplication of instruments is confusing and time waste-

ful; better to be the master of a few instruments, than the slave of many. In the preparation of a cavity, I rarely use more than two burs, perhaps one small stone, a disk or two, and several chisels and marginal trimmers. In our equipment for the preparation of a cavity for the gold inlay, we use the S. S. W. Number 701, 702 and 703 tapered crosscut fissure burs, Number 35, 37 and 39 inverted cone burs, and a small tapered carborundum stone, both straight and right angle. The Number 39 and 40 Wedelstaedt chisels and a set of Black's Marginal trimmers together with a few hoes, and spoon excavators are all the instruments necessary for the making of any cavity and to me the multiplication of instruments is an unnecessary waste of time and money. Learn to use a few instruments well and you will not need the mass of instruments that some men seem to find essential. All instruments should be kept absolutely sharp. Nothing gives me greater pain than to observe the edge on the instruments of many of the men that it has been my privilege to teach in our Post-Graduate Clubs, and about the first thing that I do is to give them a lesson in sharpening instruments. Get a fine carborundum stone of about six inches long, take the instrument with a pen grasp and draw it firmly the full length of the stone, being careful to hold it evenly at the angle required for a good cutting blade. It may require two or three strokes and if so make all of the strokes at the same angle and always the full length of the stone. The method of making little passes of the instrument over the stone in one direction or another without any definite system gives an edge that looks like the facets of a small diamond, there are so many angles on the instrument edge with a consequent loss of cutting power. The edge of an instrument should look like the edge of a good carpenter's plane. An instrument should be used but once and then discarded until it is sharpened and sterilized. We keep a dozen of each kind of instrument and as often as one is used it is placed in the used instrument drawer and is not replaced in the instrument case until it is in proper shape. The same is true of burs. Never use a bur that is not keen and sharp. It is rarely necessary to use an anesthetic if you use keen, sharp instruments and know how to use them. The time saved in the making of the operation and the ease to both patient and operator is more than sufficient compensation for the additional expense of new instruments.

The position of the patient is important. Get your chair up high enough to work comfortably. Do not get yourself in a cramped uncomfortable position for you cannot do your best work if you are uncomfortable. The same is true of the patient. Make him as comfortable as possible before you begin to operate and consider his comfort all thru the operation. The use of warm water into which has been placed a few drops of the oil of Cassia for flavor is important in that it minimizes the discomfort of the shock of cold water and the flavor is agreeable in that it removes the taste of decayed tooth debris and the uncomfortable taste of steel.

Above all take care of your hands. The hands of the Dentist are his chief asset and he should guard them as the 'apple of his eye.' The money paid to the manicurist is well spent, but better yet is the ability to care for your own fingers and nails. A good soap is indispensible, of course, and should be frequently applied. After the hands have been well soaked, the nails should be cleansed with an orange-wood stick, and with the flat end of the stick the cuticle should be freed from the nails and the margins polished with a rubbing motion. If this is done several times a day and gently accomplished, which is all that is necessary if frequently done, the nails will always be in the pink of

condition. The hands of a dentist must be the hands of a dentist. If he uses his spare time as a blacksmith, automobile mechanic or in any severe manual labor, he will have to give up the thought of being an ideal operator, for the two will not mix. Work is no disgrace and the harder the work usually the better the man, but the hands of the artist and the hands of the blacksmith are distinct and separate and you cannot combine the two. The delicate tactical nerves at the finger tips can be cultivated to distinguish between the feeling of the different tissues out of the sight of the eye, if properly developed, but they will lose their cunning if they are hidden under masses of calloused cuticle.

The fundamental principles of cavity preparation are the same no matter what may be the material you select to fill the cavity, and in the making of a cavity for the reception of a gold inlay, we follow the splendid system given us by the great master of operative dentistry Dr. G. V. Black, and only depart from the principles as taught in his work as the necessities of the method may demand.

In following his system he has taught us that we should:

First—obtain your outline form

Second—your resistance form

Third—your retentive form

Fourth—your convenience form

Fifth—remove any remaining carious dentine

Sixth—bevel your cavo-surface angle

Seventh—make the toilet of the cavity.

The outline form comprehends the doctrine of extension for prevention and the esthetic form.

Extension for prevention is that form that is given to the outline of a cavity that will bring the margins of the finished filling in to the areas of relative immunity to decay.

We know that there are certain areas of the tooth surface that are not as susceptible to the beginnings of decay as are other parts, and it is the part of wisdom and good operative ability to so arrange our cavity that the finished filling will cause the tooth to present less vulnerable points for the ravages of decay than it did at the beginning of the operation, for if we do not change the condition that called the first decay into being, what assurance have we that there will not be a recurrence of decay sooner or later?

We know that the vulnerable areas are those that harbor some defect of the tooth surface, as open pits and fissures, and smooth surface areas that are so situated that they are not habitually kept clean. It is not our purpose to enter into a discussion of the etiology of caries, but we know that decay begins upon the surface of the enamel by micro-organisms under the protection of a gelatinous plaque, and that this plaque cannot form upon any surface of the tooth that is exposed to the frictional action of the food in mastication, therefore the immune areas of the teeth are those that are kept clean by the excursions of the food in mastication, and by the movements of the tongue and lips. It is for this reason that we rarely find cavities upon the lingual surfaces of the teeth, and never upon the occlusal surfaces except where they start within a defect. The buccal and labial areas that are immune are all of those surfaces between the mesial and distal angles and so far removed from the gingival margin that the curve of the tooth inciso—or occluso-gingivally does not allow food debris to lodge and be retained.

There is a decided difference in the immune territories in different individuals owing to the shape of the teeth, the arrangement of the teeth in the arch and the masticatory habits of the patient, therefore the repeated injunction to study conditions. The author is convinced from a long study of cases, that the masticatory habits of the individual are more responsible for tooth decay and the beginnings of pyorrhea than any

other agency and if we could impress upon our patients the necessity of thoroly chewing their food and then eating a diet that required a good stiff mastication, we would more nearly solve the problem of tooth difficulties than anything else in the world.

The vulnerable areas are those within defects of the teeth as in all defective pits and fissures, and on those smooth areas that are protected from the friction of the food in mastication, and from the movements of the tongue and lips. The most vulnerable area and the place where we most frequently find decay is on the approximal surfaces of the teeth just gingivally to the contact point, for here is an ideal place for the organisms of decay to attach themselves and begin their work undisturbed by mastication or the ordinary use of the tooth brush.

In making our outline form then, to conform with the doctrine of extension for prevention, we must cut our cavity buccally and lingually so far that the margin will be far enough out of the embrasures that the margin of the finished filling will be perfectly clear of approximating tooth or of filling in the tooth. It must be so far out that it will be self cleansing, that is, that the bolus of food as it travels down the tooth as it is crushed in the act of mastication, will scour the margin of the filling from occlusal to gingival. It is at the gingival angle that the most care should be taken, for here is the point of greatest vulnerability, and here more than anywhere else is there a recurrence of decay. The older operators insist that this is because there is not the perfect adaptation of the filling here, as there is at other points, owing to the difficulty of manipulation, and while that is true to some extent the fact remains that fillings that are so made that the angles at the gingival margin are brought well into territory that is kept clean, do not decay in a degree at all comparable to those that are not so made. It is important then that the lines of the cavity buccally and lingually should be brought well out of the embrasures from the occlusal margin down to the gingival angle. The gingival margin should be carried well under the free margin of the gum, for we know that the tooth does not decay under healthy gum tissue. It is well to bear in mind the last part of that sentence—under healthy gum tissue, and be sure that we leave the gum in a healthy condition, for a great deal of harm is done by careless or ignorant operators in mutilating the delicate septal tissue either in the making of a cavity or in the polishing of the filling, or what is worse, leaving a rough gingival margin to the filling or leaving a bad overhang which will serve as a continual source of irritation, which will set up an inflammation, which will cause a congested condition of the gum or will cause it to recede leaving a vulnerable area for a future recurrence of decay.

Upon the occlusal surface it is only necessary to carry the margins of the cavity into smooth territory, for all of the occlusal surface is in immune territory except as the defects on the surface of the tooth make for susceptibility. That is, the organisms of decay will lodge within an imperfect fissure and will there be protected from the scouring action of the bolus in mastication and will therefore be able to maintain itself in its chosen position and commence its work of destruction. It is necessary therefore to cut out all imperfections upon the surface of the tooth whether decay has begun within them or not, and to cut to the entire extent of the fissure that the inlay may have its margin in smooth territory, for if this is not done and the filling is finished within a fissure or pit, it will leave a rough uneven surface that will be ideal for the lodgement of bacteria and food debris and a recurrence of decay will in all probability supervene. The rule then is to cut all occlusal surface cavities to the entire ex-

tent of the fissure or pit and finish the margin in smooth territory. In the making of a filling in the approximal surface of an incisor the common fault is not to cut the lingual surface far enough distally in a mesial cavity, and mesially in a distal cavity, that is, that not enough lingual extension is made, therefore leaving the margin of the filling in lingual contact with the approximating tooth or filling in the tooth, making a point of susceptibility and we find a great deal of failure at this point due to this faulty preparation. In the making of an inlay this fault is obviated, for we never approach a cavity in an incisor or cuspid from the labial surface. To do so would make a filling that would be very unsightly indeed. I have seen teeth, that were so treated, that were most unsightly and a positive disfigurement to the patient. All cavities in the incisors and cuspids that are to be filled with a gold inlay should be approached from the lingual surface and the extension so made that the filling should come thru to the labial surface far enough to clear the tooth from contact with its fellow and allow the contact to be made upon the filling or inlay. In this way, the lingual extension is always sufficient, tho care must be exercised to make the labial extension wide enough and particularly is this true at the labio-gingival angle. All gingival angles are the areas that need the greatest care in making the cavity preparation for here the operator is liable to be caught napping, tor the tendency is not to cut the labio, and bucco—and linguo-gingival angles far enough, and more recurrence of decay is to be found in these areas than in all of the rest of the susceptible areas combined. This is more true of the inlay than it is of the filling and it is bad enough in its occurrence there. The reason that we find this true in the case of the inlay is because the operator thinks that it is necessary to make the cavity slightly cone-shaped with the apex toward the gingival margin, that the wax may draw and the inlay may more easily seat, and by reason of the conical shape of the cavity may seat deeper in the cavity, and thereby take up some of the discrepency of the inlay at the gingival margin, due to faulty manipulation of the inlay technic. This is not necessary and is vicious in that it makes a highly susceptible area at the most vulnerable point of the cavity margin. Square out all of the gingival angles and be sure that they are all out of the embrasures far enough to be in territory that is automatically kept clean.

The esthetic form is that form which we give to a cavity that will most highly conserve the beauty of the tooth and the whole denture. The tooth tissues should be conserved as much as possible for no material at our disposal approaches in any degree to that of healthy enamel in its beauty or strength when supported by a sufficient mass of dentine, but when not so supported it must, in most cases, be sacrificed for reasons of safety and the integrity of the inlay. Enamel is the hardest and one of the strongest tissues in the body when its integrity is unbroken and will stand the severest tests without breaking down, but when decay has so far progressed that it is not supported by sound dentine it has very little strength and it is not advisable to attempt to test it by making an inlay in a cavity that has enamel walls unsupported by dentine, for it will be to invite failure if there is any degree of stress upon the finished work. Inasmuch as enamel is very translucent it will show the cement color if there is no dentine back of it, therefore for esthetic reasons, it is not advisable to leave any overhanging enamel that will be discolored by the cement and make an unsightly appearance. If the enamel is so preserved it will be advisable to use a cement that will approach the dentine in color as closely as possible. All angles that come within range of vision should

be gently curved for nature abhors angles, and they should never be used where they will be seen. This is one of the reasons for approaching cavities in the proximal surfaces of the incisors from the lingual aspect, as it is necessary in the making of an inlay, to make it angular for retentive reasons, and if we were to approach the cavity from the labial surface, we would have an inlay that would be almost rectangular in its outline. This is most unsightly and should never be done where it can be seen. The inlay should conform very closely to the size and shape of the tooth for nothing is more unsightly than a tooth that is not of a harmonious size and shape. It would be preferable from an esthetic view point to have a tooth of inharmonious color rather than one of irregular size and shape. A tooth, whose form is perfectly restored with gold, is much more beautiful than one that was not so restored even tho its color was perfect. Therefore, in the esthetic form, strive to make a cavity preparation that will permit of perfect tooth restoration and make all external lines of a gently flowing curve, avoiding all sharp angles that will come within the range of vision.

The resistance form is that form which we give to a cavity that will best resist the thrust forces that will come upon the finished inlay. When we remember that the gnathodynamometer gives us a masticatory thrust of from 100 to 300 pounds, in the mouths of different individuals, we will see the necessity of making our resistance form of sufficient size, form, and shape to properly resist the forces that will be brought to bear upon the inlay. In order to intelligently lay out our resistance form we must know something of the stress that the inlay will be called upon to resist, for we have seen that in various individuals there will be a demand varying from 100 to 300 pounds pressure, and it will therefore be necessary to determine with some degree of accuracy the amount that the particular individual under consideration will exert. For it would be foolish and cruel to cut as wide and deep a cavity for a delicate, weak woman that would scarcely close the gnathodynamometer 100 pounds as it would for some big bruiser that would send the indicator of the instrument up to 300 pounds or over, and conversely it would not do to cut as shallow a cavity for the last individual as for the first as that would be to invite failure. Therefore, we must carefully study the conditions of stress that will have to be borne by the inlay and lay out our cavity preparation accordingly. The ideal preparation for the resistance form is the box shape, flat seat and parallel walls with a sufficient depth to insure a mass of gold that will not flow under the stress that it will have to bear.

It is axiomatic that a flat base will stand more stress without movement than a curved one, for here the entire weight is distributed over the entire base, while if the base is curved some one part of the base will have to bear more of the weight than others, and there will be a tendency to rock if the edifice is built upon a foundation that is spherical in form. It has been argued that a flat base would not conform to the cemento-enamel line as that is more curvo-linear than straight, and the answer is that in the molar region there is not a very great curve of this line and not much more in the bicuspid region, and moreover, it is rarely necessary to approach this line in the making of a cavity so that does not militate against its use in these teeth, but in the incisor region we do find that the cementum curves up sharply toward the enamel in the approximal region and we therefore prefer to make the gingival base here with a curve to conform to the cemento-enamel junction, for we know that there will not be the stress upon an inlay in this region as there would be in the molar or bicuspid territory. The parallel walls are of great assistance in

the maintainance of the inlay against thrusts as they hold the inlay firmly upon the flat base and prevent any rocking tendency, as might be the case if the walls were curved. The depth of the cavitv plays a very great part in the integrity of the inlay, for if the cavity is sufficiently deep there are walls of dentine that firmly grasp the inlay and prevent movement, while if the cavity were shallow there would not be sufficient dentinal grasp to insure against movement, if the stress were very great. It is therefore of the greatest importance to have the cavity deep enough to insure a firm grasp of the dentinal walls upon the inlay, and also to insure a sufficient mass of gold to prevent flow. Gold will flow under stress, and this is particularly true of cast gold, as it is in its softest form. Gold is hardened by beating or rolling, and is softened by heating and melting, therefore, cast gold is the softest form of gold and must be of sufficient mass to insure its being able to prevent a flow that would be ruinous to the inlay. The depth of the cavity must be determined by the stress that is to come upon the inlay for we should not cut any tooth more than it is absolutely necessary. Tooth structure is the most valuable thing in the dental organ, and no material that we can place there will compensate for its unnecessary loss, and it is a matter of good judgment that is only developed by study and experience to know how far to cut and when to stop, for no two cases are the same. We must know the conditions that we are to restore and then apply the scientific principles of cavity preparation to these conditions or to use the oft repeated injunction of that prince of operators, Dr. E. K. Wedelstaedt, "Study Conditions." If necessary to have a great resistance to stress, we must cut more deeply, but if not, we should not cut any deeper than absolutely necessary for we must always remember that we are operating upon live tissue and the closer we approach the pulp the greater is the danger of pulp complications.

The retentive form is that form that we give to a cavity that will prevent the inlay being pulled out of the cavity. In the making of the filling it is permissible to make some undercuts, but this is contraindicated in the making of a cavity for the inlay, for in case we did, the wax would not withdraw without distortion, and the inlay would not go to place even tho we were able to withdraw the wax pattern. Therefore, in order to give the maximum resistance to the displacement of the inlay, we employ parallel walls. In proportion to the departure from the parallel do we destroy the frictional resistance of the inlay to the walls of the cavity, and the more cone-shaped the cavity the greater the tendency to displacement under stress. Make all of the walls of the cavity as nearly parallel to each other as it is possible and in doing so obtain the greatest resistance form that it is possible to give a cavity for an inlay, and if the cavity is deep enough, you will have no difficulty in the inlay falling out of the cavity.

The convenience form is that form that we give to a cavity that enables the operator to perfectly adapt the filling material to the walls of the cavity. In the making of a filling, this form is of the greatest importance, for no matter how well a cavity may be prepared, if the filling material is not perfectly adapted to the walls of the cavity, thereby hermetically sealing the cavity against the ingress of moisture, the filling is failure, and as it is extremely difficult to adapt a material like gold foil against a wall or margin that is not in such a position that you have direct access, it is always advisable to make all cavities of convenient form, for it is better to sacrifice some of the tooth in the interest of the entire organ rather than to attempt to save an insignificant portion and lose the whole tooth thru the recurrence of

decay because the filling had not been perfectly adapted to the cavity walls.

This form is not so essential in the making of an inlay, for in nearly all positions the wax can be perfectly adapted to all of the walls of the cavity, and the inlay can be perfectly cemented into the cavity when completed. Nevertheless, if in any place it is better to sacrifice a portion of the tooth in order to insure a more perfect adaption of wax, or a more perfect insertion of the inlay, it is the part of wisdom to do so.

Remove Any Remaining Carious Dentine.

It is always necessary to remove all of the infected dentine, for not to do so will endanger the life of the pulp. There are some operators that seem to think that because the cavity is sealed with cement in the making of an inlay, that it is permissible to allow some of the infected dentine to remain rather than to approach too near the pulp. This is always a dangerous policy and should never be tolerated, for it invariably leads to disaster. Far better to remove a healthy pulp and fill the pulp chamber than to allow the pulp to die under a filling and have the entire dentine infected by the organisms of putrefaction. It is possible under aseptic precautions, to fill a clean pulp canal without infection, but it is almost, if not entirely, impossible to perfectly disinfect a tooth that has once been thoroly infected as is the case in a tooth that has had a putrescent pulp.

It is sometimes permissible to allow the decay to remain in the cavity until the wax pattern has been made, because to remove it before would make an undercut that would prevent the making of an inlay in such a cavity. But it is a doubtful expediency and one fraught with a good deal of danger, for it is possible to force the pathogenic organisms contained in the mass of decay, thru the dentinal tubules into the pulp, with dire consequences. It is much better in such cases to remove the decay and fill in the undercut with a good cement and then make the pattern. In case you do not wish to wait for the hardening of the cement, it is a good plan to take a small piece of modeling compound and fill in the undercut, then make the pattern, remove the compound and cement the inlay into place and the cement will fill in the discrepancy in the cavity.

The making of the Cavo-surface angle is one of the most important parts of the making of a perfect cavity. Enamel is one of the hardest and strongest materials in the body when its continuity is unbroken, but by reason of its structure, it is very weak when broken and not supported by healthy dentine. In the making of a cavo-surface angle, it is possible to leave innumerable short enamel rods that will be very easily displaced under the slightest stress. If this is done after a filling or inlay is in position, it leaves a vulnerable space for the ingress of moisture and contained organisms with a subsequent recurrence of decay. Therefore, it is advisable to bevel the enamel walls all around the cavity. This is done that all of the short rods may be removed and the inlay adapted to strong enamel walls and also to have a flange cast upon the inlay that may be more perfectly burnished to the cavity. This is not necessary to enable us to make a perfect fitting inlay, in other words, it is not "camouflage" as one writer has recently declared, for with the perfecting of the process of casting as will be described later, we are enabled to cast perfect fitting inlays upon butt joints, but the flange is a more definite and satisfactory method, and then it is a necessary part of the inlay in the making of one to fit a cavity that has had the cavo-surface angle beveled to remove the weak enamel margins. The margins are beveled with the Black marginal trimmers and upon the occlusal surface with small carborundum stones.

The toilet of the cavity contemplates the removal of all debris and the thoro cleansing of the cavity. In the making of a cavity for the reception of an inlay, it is not necessary to use the rubber-dam tho that is the ideal in the making of any cavity, and if the dam is not used it is always advisable to wash out the cavity with warm water, then dry and cleanse with alcohol or chloroform previous to the insertion of the temporary stopping in the interim of the making of the inlay, for if that is not done and the patient is sent away with a plug of gutta-percha placed upon a mass of infected material in the cavity, the pounding upon the filling in the process of mastication will force the organisms thru the tubules into the pulp and you will have a very sensitive tooth when the patient returns if you do not have an inflamed pulp. In order to prevent this, the cavity is cleansed as described and then a dressing of Eugenol is applied and the gutta-percha plug placed in position. If this is carried out there will be no discomfort in the time between appointments and the tooth will be in better condition upon the return of the patient than it was when the cavity was first finished, owing to the antiseptic and soothing effect of the medicament. Before the placing of the inlay the cavity should be again cleansed and washed out with alcohol to remove any of the oil, and leave a clean dry surface for the adhesion of the cement.

Cavities Are Divided Into Five Classes.

Cavities of the first class are all of those cavities occurring in the natural defects of the teeth. These defects are the fissures and pits occurring upon the buccal surfaces of the lower molars and lingual surfaces of the upper incisors, and occasionally fissures upon the occlusolingual surfaces of the molars, both upper and lower. These imperfections are due to the failure of the enamel plates to perfectly fuse together in the process of tooth formation with a consequent discrepancy in the enamel and a place for the ingress of the organisms of decay.

Cavities of the second class are those occurring in the proximal surfaces of bicuspids and molars.

Cavities of the third class are those occurring in the proximal surfaces of incisors and cuspids not involving the angle.

Cavities of the fourth class are those occurring in the proximal surfaces of the incisors and cuspids involving the angle.

Cavities of the fifth class are those occurring in the gingival thirds of the labial, buccal or lingual surfaces of the teeth.

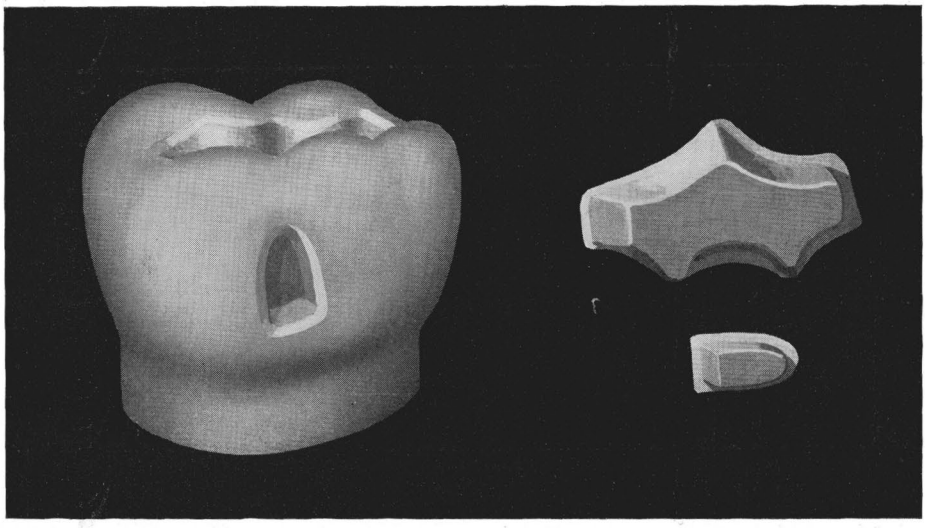
It is important that we should be perfectly familiar with these classifications as each class of cavities calls for a different manner of treatment.

Chapter II.

Cavities in the occlusal surfaces of lower molars are class one cavities and are made possible by defects in the fusing of the enamel plates, thereby allowing the organisms of decay to penetrate the enamel and gain an entrance directly into the dentine, where they can operate without disturbance, because of the protection afforded by the overhanging enamel. In these cavities, we will often find that there is great destruction of the dentine, before there is any outward manifestation of decay. We sometimes see the decay progress so far that the pulp is exposed before there is a breaking down of the enamel walls. Because of these facts, it is the duty of every dentist to thoroly examine all of the fissures in the teeth of children to see whether these sulci contain defective fissures, and if so to immediately eradicate them. In the light of our present knowledge of the fearful effects of diseased teeth on the human economy, we should exercise the greatest care to seek out and eliminate the slightest tendency to decay and not wait "until the cavity gets big enough to fill" for

to do so invites pulp complications with all of its sequela. The surest way to deal with the filling of root-canal problems is to avoid the necessity of filling them, and that can best be done by a thoro system of prophylaxis, the finding of cavities in their incipiency and the filling of the same at the earliest opportunity.

The outline form is obtained in this class of cavities by taking a No. 701 or 702 S. S. W. dentate fissure bur, and inserting it in a defect of the fissure, and follow it to its end. In this way cut out each fissure until all of them are eliminated and the margin of the cavity lies in smooth territory. Then with a No. 40 or 41 Wedelstaedt chisel break down the overhanging enamel walls until you obtain the outline you desire. Inasmuch as the occlusal surface of the molar lies in immune territory, it is only necessary to carry out the lines of the cavity in this class until all defects are removed and the margins can be made in an area that is smooth. It must be emphasized that all of the fissure must be cut out to their entire extent, or there will be a failure owing to the margin lying in a rough region and a consequent possibility of the penetration of the organisms of decay under the defect occurring because of the impossibility of making a perfect adaptation of the filling or inlay on such a surface. We have all seen the ridiculous method of making four or five pinhead fillings in the occlusal surface of a lower molar, because there were four or five distinct defects in the sulcus of the tooth, and the operator, instead of cutting out the fissure and making one good cavity of the entire defect, made a separate cavity of each starting point of decay, and in a short time had the pleasure of seeing the tooth redecay, with cavities radiating from the several fillings he had placed in the tooth.



Figures 1 and 5.

If there is little decay it will not be necessary to make the cavity very wide, —only so much as is necessary for the making of a good inlay. The outline form here will very nearly represent the general form of the original fissure as depicted in Figure 1.

The resistance form is obtained by making the cavity with parallel walls, and this is easily and expeditiously performed by the use of the same fissure bur that we used in opening the cavity. Hold the bur at an even angle and sweep around the walls of the cavity with the engine in rapid motion, and in a very short time the walls of the cavity will be paralleled, and at the same time the seat of the cavity made flat, for the end of the bur is flat and will cut a flat seat. In this way, we will rapidly produce both the resistance and retentive form of the cavity. It will only be necessary to make the cavity deep enough to insure the security of any inlay that we might place there. In this class of cavities, the problem of retention is very simple indeed, for the nature of the cavity lends itself very readily to the ideal, that is the box form, indeed it is almost impossible to avoid the making of the cavity properly unless there is a deliberate attempt to do so.

If there is much decay it will be necessary to make the cavity considerably wider, so that there will be no overhanging walls of enamel, for if there are there will be danger of their breaking down under the stress of mastication and making a failure of the operation. It is not safe to depend upon the reenforcement of the enamel with cement in any place where there is any appreciable stress, for enamel deprived of its dentine support is very weak, and while cement will help to some degree, it is not safe to depend upon it in this position. Cut out all enamel that is not supported by sound dentine, and if the margin approaches too near the marginal ridge for safety, cut off a sufficient portion of the enamel wall and restore with gold.

Figure 2, illustrates a cavity cut wider because of the width of decay. In this class of cavities it is not necessary to cut very deep as the stress of mastication is such that the inlay is not endangered, for the four walls offer so much resistance to stress that there is little or no danger of the inlay being forced out of the cavity. A cavity of 1½ millimeters in depth is amply sufficient to maintain itself in a cavity of this class.

If there is any remaining decay, it must now be removed, and if its removal makes an undercut, this must be treated in one of the ways before suggested. The beveling of the cavo-surface angle in this class of cavities is most easily accomplished with a small tapered carborundum stone, held at the proper angle in the hand piece, so that a definite angle

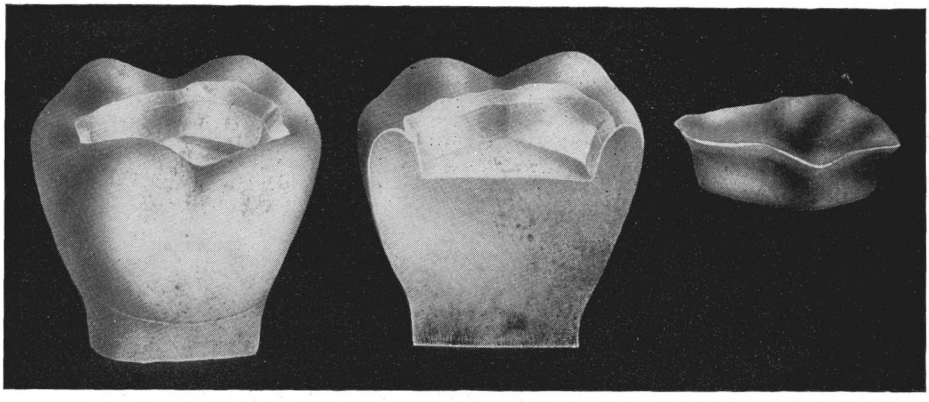


Figure 2. Figure 3.

may be made all around the margin of the cavity. It is permissible to use a stone in the making of the cavo-surface angle for an inlay, but is not so for the making of such an angle for a gold filling, for it has been demonstrated that a polished surface is much more difficult to adapt gold against than is a planed surface, therefore, in the making of the cavo-surface angle for a gold filling, we advise the use of the chisel. This does not obtain in the making of an inlay, however, and as it is easier to make the cavo-surface angle on the occlusal surface with a stone, there is no objection to its being done. Figure 3 is a cross-section of a cavity of the first class, showing the flat seat, the depth of the cavity, the parallel walls and the width and angle of the cavo-surface angle.

In the making of the cavo-surface angle, it is necessary to know the direction of the enamel rods in their relation to the conformation of the tooth surface, for in different parts of the tooth the rods lie in different directions in relation to the dentine. In Figure 4, we reproduce a cut made by Dr. Fred B. Noyes. Dr. Noyes has very kindly given his permission for the use of this splendid illustration of the direction of the enamel rods.

By a study of this cut, it will be seen that the rods at the gingival margin have an inclination from the dento-enamel junction toward the periphery of the enamel in the direction of the root of the tooth, so if a cavity were made here and a direct cut were made across the enamel wall, as in the so-called butt joint, there would be many rods that would be cut off and leave many short rods at the surface of the cavity. That is, many of the rods at the surface of the cavity would not reach to the dentine, and as a consequence would be very frail and would break under the slightest stress. At this point, it is necessary to bevel the margin quite decidedly in order to protect the enamel rods. As we pass up the tooth toward the occlusal surface, we find that there is a straightening of the rods so that in the middle third of the tooth the rods are practically perpendicular to the dentine. Then, as we approach the crown, it will be seen that the rods bend in the opposite direction attempting in a general way to conform to the shape of the dentinal cusp, finally

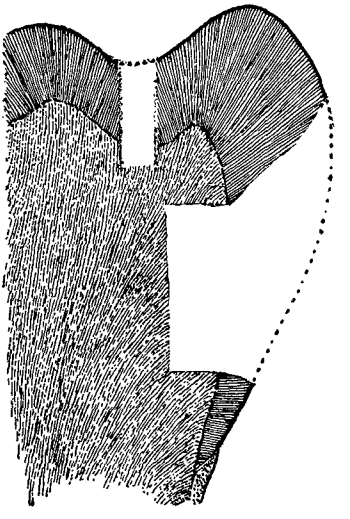


Figure 4.

The two classes of cavities. Those with the rods inclined toward the cavity, and those with the rods inclined away from the cavity.

Used by Permission of Dr. Noyes.

bending over the crest of the dentinal cusp and again taking on an opposite direction and falling in toward the sulcus until as they are in the immediate vicinity of the sulcus, they are tipped decidedly toward it. This is true of all pits and sulci, so that a cavity prepared with its cavo-surface angle near a sulcus need not have the bevel that it is necessary to give to a margin removed from such a position. Conversely it will be seen that the nearer we approach the enamel cusp the greater will be the necessity of a decided marginal bevel, until as we reach the crest of the cusp, it will be wise to

go beyond and cut off a portion of the cusp for the safety of the enamel margin. We can but touch upon this subject here, but its importance is so great that we must insist that the student familiarize himself with Dr. Noyes's splendid presentation of the subject in his Dental Histology and Embryology.

Cavities occurring in the buccal pits of the lower molars are also class one cavities and are treated as such. They are most easily approached by the use of the right angle carrying a 701 or 702 S. S. W. dentate fissure bur. The cavity is entered and the fissure or pit cut out until smooth territory is reached. The walls are paralleled and the seat made flat. The depth of the cavity is only so much as is made necessary by the depth of the decay. There is practically no stress of any kind upon an inlay in a cavity in this position so that a great deal of attention is not necessary to resistance and retention forms. The depth of the cavity should always be sufficient to penetrate the dentine and if that is accomplished in this case and the decay is thereby eliminated, the cavity will be of sufficient depth to resist all of the stress it will have to bear. In case the depth of penetration of decay is greater, it will be necessary to cut deep enough to remove all decay, but if the decay is deeper than it seems wise to make the cavity for the reception of the inlay, the decay can be removed, a little cement placed in the bottom of the cavity and the preparation completed in the cement. The margins should be beveled as in all other cases, altho there is less need of it in this position than in almost any other class of cavities, for being in proximity to a pit,

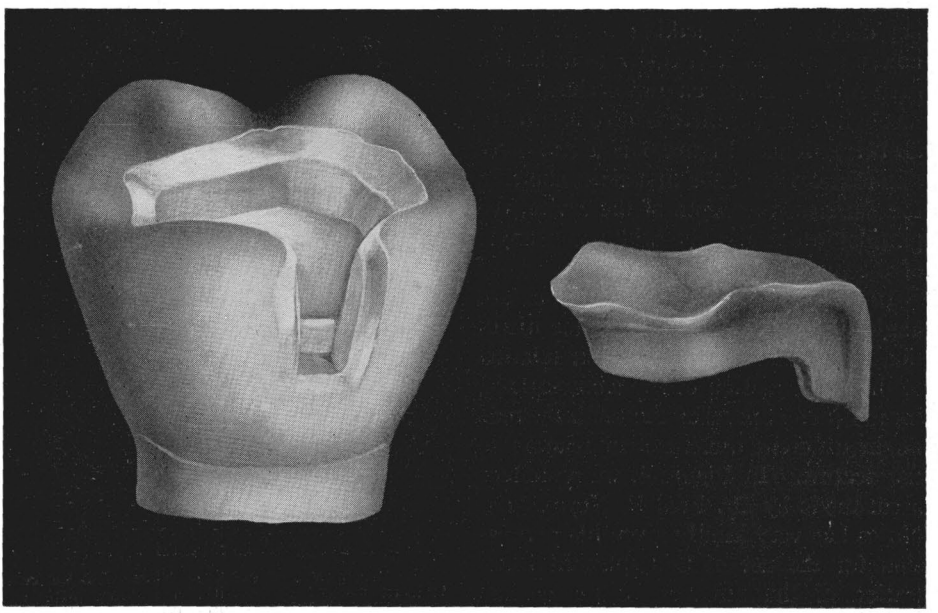


Figure 6.

the enamel rods incline toward the cavity and a straight cut into the cavity would leave no short rods upon the surface, nevertheless, we feel that the safety of the tooth is better conserved by the beveling of the margins and the making of a definite cavo-surface angle even tho it is not absolutely demanded.

Figure 5 illustrates a cavity prepared in the buccal pit of a lower molar. In Figure 6, we have illustrated the treatment accorded a cavity in the occlusal surface of the lower molar in which the buccal pit is also involved, making a complex cavity. In this case the cavity has been of such an extent that the decay from the cavity in the buccal pit has met the decay in the occlusal surface, making a weak marginal ridge by leaving the enamel unsupported by any dentine. It is then advisable to cut across the marginal ridge from the occlusal surface into the cavity made in the buccal pit and treat the two cavities as one. The general treatment is the same as if the cavities were treated separately, that is, the walls should be parallel, the seats flat and the margins beveled. Care should be taken to see that the enamel margins on the walls of the cavity as it passes over the marginal ridge should be well beveled and that the bevel should be long, that the greatest strength would thereby be given to both the enamel margins and the gold in the inlay, for at this place the enamel rods need particular attention as they are at the crest of the cusp and it is very easy to leave short rods exposed. Again, at this point the tooth has to bear the greatest amount of masticatory stress as the teeth move over one another in the grinding motion of mastication, and if the cavo-surface angle were not made sufficiently deep, thereby affording a sufficient amount of gold to resist stress, the gold would flow and a weak spot would be made in the protective capacity of the inlay.

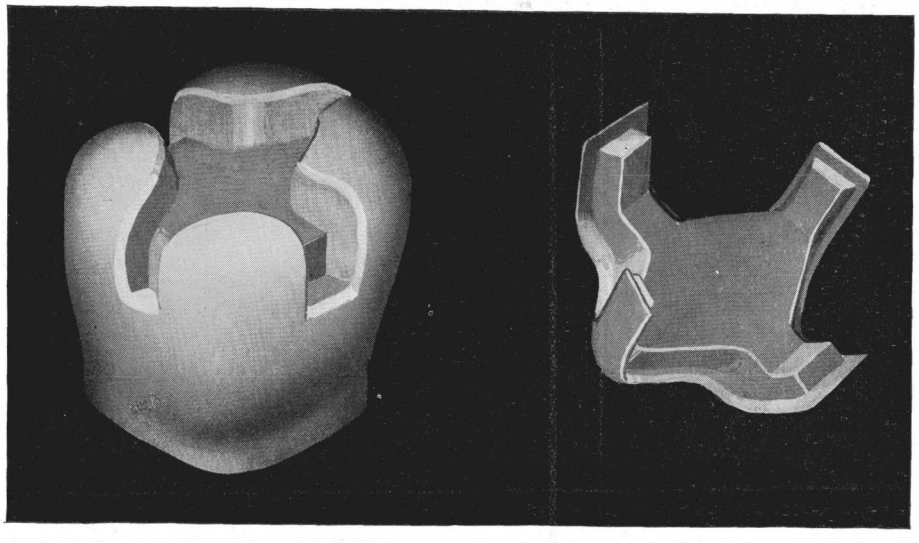


Figure 7.

In case the decay does not penetrate from one cavity to the other, it is still

sometimes advisable to cut across the marginal ridge and make one cavity of the two. This is the case if there is a defect in the closure of the fissure as it passes over the ridge, which is frequently the case. If there is a fissure at this point and it is ignored and two inlays are made, the one in the occlusal and the other in the buccal surface, it will leave a vulnerable place between them and in the process of time there will be a cavity with the possible destruction of both inlays.

In the case of the fissure cut thru from the occlusal to the buccal with a fissure bur, widen the cavity with chisel and mallet, and prepare as tho the cavity had been made by decay, as in the illustration in Figure 6.

In rare instances we find it also necessary to extend the cavity over the lingual marginal ridge as well. In that case, the same procedure is followed as in the case of the fissure extending over the buccal marginal ridge, and the cavity prepared in exactly the same way. In Figure 7, we have illustrated a cavity in the occlusal surface of a lower molar in which the cavity is carried over both the buccal and lingual marginal ridges and cavities in the lingual and buccal surfaces made onc with that in the occlusal surface. This cavity is decidedly complex and care must be exercised that in making the parallel walls of the cavity there are no undercuts that would militate against the perfection of the model. In this class of cavities, it is permissible to depart slightly from the paralleling of the walls as there is ample frictional resistance afforded to maintain an inlay against any degree of stress that is liable to come against it. Therefore, it is permissible and even advisable to depart slightly from the absolute parallel and cause the internal lines of the cavity to recede from one another as they travel over the buccal and lingual aspects of the cavity, thereby making a sort of inclined plane, upon which the finished

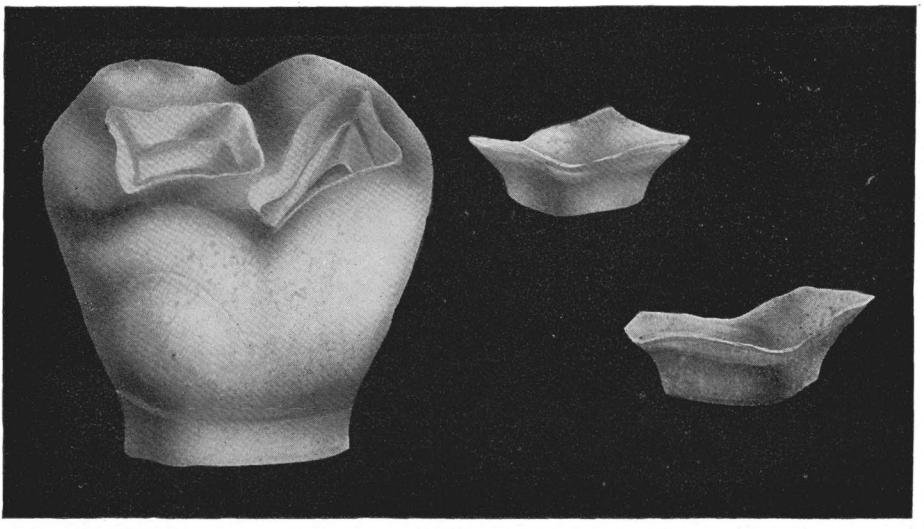


Figure 8.

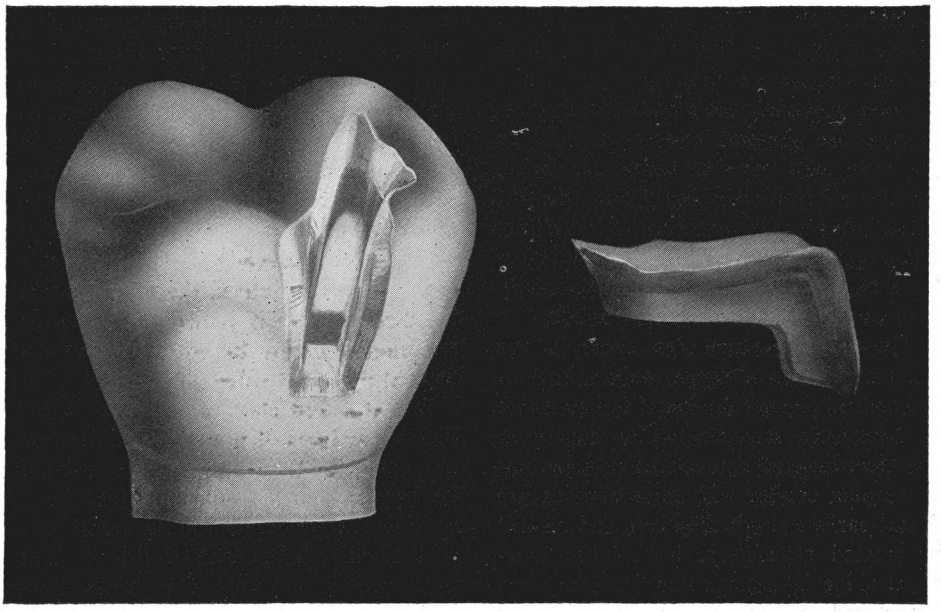


Figure 8.

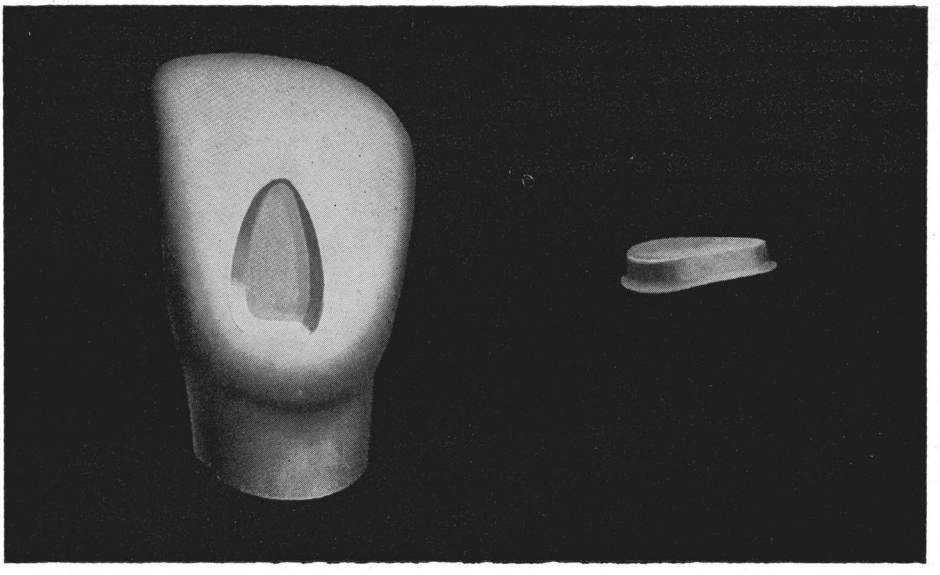


Figure 9.

inlay may ride to its seat in the bottom of the cavity. If this is not done, there is the danger of making these walls slightly approach each other as they go toward the gingival margin, and if so the wax will have to spread in being withdrawn from the cavity and the finished inlay would be found to have flaring wings in the buccal and lingual portions that would extend out of the cavity and we would have a decided misfit.

Class one cavities also occur in the occlusal surface of upper molars, both in the central pit and the distal fissure which is frequently complicated by taking in the disto-lingual fissure and thus making a complex cavity. If these cavities are found early enough they can and should be treated separately, but if the marginal ridge is defective or the decay has progressed so far in either cavity that the integrity of the ridge is threatened, then it will be advisable to treat the cavities in the distal fissure and the lingual fissure as one and make the cavity a complex disto-lingual fissure cavity. And if the decay has undermined the oblique ridge to any appreciable extent, the cavities in the occlusal surface should be joined by cutting across the ridge and making one cavity of the two.

The preparation of all of these cavities is identical in its principles with that of the cavities in the lower teeth. The seats are made as deep as necessary to eliminate the decay, but not too deep, as depth is not necessary for retention in these cavities. The seats are made flat and the walls parallel, with a generous beveling of the cavo-surface angle. Figure 8 will illustrate both of these cavities. It will be noticed that the cavity in the distal fissure is joined to the one in the lingual fissure by cutting across the lingual marginal ridge.

We also find class one cavities in the lingual surfaces of upper lateral incisors and occasionally in the lingual pits of the upper centrals. (Figure 9.) These cavities are prepared in the same way as the other class one cavities. The seats are made flat, the walls paralleled and the cavo-surface angle is beveled. Great care must be exercised in this region that the pulp be not exposed, for it is not very far from the surface and a little injudicious cutting will endanger it. Fortunately, it is not necessary to make a deep cavity for retentive purposes, as there is very little stress upon the inlay at this point, so if the cavity penetrates the enamel and is anchored in the dentine, the depth will be sufficient for all practical purposes.